of the ecliptic whose longest and shortest day, for our northern hemisphere, would coincide with the north and south plane, passing through the Alpine focus and also through the node of intersection for the terrestrial and magnetic Equator. This gives us one great circle from Behring's Straits to its antipodal Antarctic, due south from Mt. Rosa; the other from Scandinavia, at the Arctic Circle, to the antipodal point on the Antarctic, which will be found due south from Behring's Straits. As these ran through the northern hemisphere, the course of one from the volcanoes of Sumatra is nearly parallel to the formerly described Asiatic continental trend as well as the Japan Gulf Stream, and nearly parallel again through North and South America to said Asiatic trend prolonged, whereby a region is inclosed of Nevada geysers, New Madrid earthquake region, Arkansas and Virginia hot springs, Cuban, Venezuelan, Grenadan, Peruvian, and Chilean volcanic and earthquake regions. The course of the other, while running nearly parallel to the North American east coast trend, is from the thirty-nine volcanoes (see Dana's Manual, p. 703) of Central America to the geyser and volcanoes of Iceland, thus inclosing between it and the North American trend our Gulf Stream, probably even aiding to heat it; while on the opposite side of the globe the inclosed line embraces the Hindoo Cush and Western Himalaya elevations; the disturbed regions of Hindostan and islands in the Bay of Bengal (some brought up within the Historical Period) as well as the numerous volcanoes of Sumatra.

The evident connection of these laws with Terrestrial Magnetism, Mining and Mineralogy, Archæology and Ethnology, is left for future discussion.

AN INVESTIGATION OF THE VIBRATIONS OF PLATES VIBRATED AT THE CENTRE.

By THOMAS R. BAKER.

MOST of the plates used were window panes of various shapes and sizes. They were vibrated by rubbing an attached glass rod. The tubes, which were about $\frac{3}{16}$ of an inch in diameter and 20 inches long, were attached at right angles to the face of the plate with sealing wax. The support for the plate was a rubber cap, the common lead-pencil eraser, fitted on the end of a post projecting from a disk of lead. A short rubber-capped lead pencil fixed upright in a wooden block answers the purpose just as well.

The plate was balanced on the support, the tube standing upright and held loosely between the thumb and forefinger of the left hand. Then catching the tube between the moistened thumb and forefinger of the right hand and rubbing downward the vibrations of the plate were produced.

Different tones were obtained from the same plate by varying the pressure and the position of the thumb and finger. Each plate yielded from *one* to *six* tones, the number increasing with the size and thinness of the plate. A plate 10 in. by 14 gave *six* tones, one 4×4 gave *two*, and one 3×3 gave but *one*.

The interval between the lowest and second tones of a 10×12 plate was *two octaves and one tone;* between the second and third, a *diminished sixth;* and between the third and fourth, an *augmented fourth*. The greatest interval found between the lowest and highest tones of a plate was more than *four* octaves, and the greatest interval observed, considering the tones of all the plates tried, was more than *five* octaves.

Plates were reduced in size by cutting strips an inch broad from them, and a test was made of the tones of each plate thus produced. A plate 12 inches square was cut down to 11 in. by 12, then to 10x10, and so on until it was reduced to one 2 inches square. By this operation there was furnished a series of eleven plates closely alike in thickness and structure.

The intervals between consecutive tones of each plate of this series down to the plate 7x7 were almost uniform, namely; *two octaves and a fourth* between the lowest and 2nd tones, a *seventh* between the 2nd and 3d, and a *fourth* between the 3d and 4th. From the plate 8x8 to that 3x3 the intervals between the lowest aud 2nd tones were almost uniform, being about *one octave and a fourth*. The other intervals were variable. The difference in pitch of corresponding tones of consecutive plates was with few exceptions, uniform down to the plate 7x7, namely; *three semitones*.

The following is a summary of the facts derived from these experiments: 1. The difference in pitch of the lowest and 2nd tones of all plates tried between the sizes 10 in. by 14, and 7 in. by 7, was *two octaves* to *two octaves and a fourth*, and the difference in pitch of corresponding tones of square plates between the sizes 8 in. by 8, and 3 in. by 3 was *one octave and a fourth*. 2. The intervals between the tones of plates giving *not more than five* tones diminished as the pitch increased, but this was not true of plates giving *more than five* tones. 3. The pitch of tones given by a series of plates which varied in size as the square of a series of numbers whose common difference is one made a sudden leap from one uniform scale to another.

The forms of these variations were learned in the usual way by vibrating the plates with sand sprinkled over them. The figures were copied by placing the plate over paper which had been wet with a solution of potassium bichromate and dried in the dark. The plate and paper were exposed to diffused light or to the vertical rays of the sun. The paper not hid by the sand soon darkened and when this change had taken place the plate was removed and a lead pencil run along the bands of lighter colored paper representing the sand lines. This paper was then placed on white paper and the figures copied by pressure. About 150 sand figures were copied and traced.

The vibrating of plates at the centre as here described, seems to be the best method for class illustration, the main object being to show the formation of sand figures. To vibrate a plate at the centre in this way, expensive apparatus is not needed, a pane of window glass, a glass tube and a rubber eraser—the essential articles—being procured at the cost of a few cents. To vibrate a plate in the ordinary way, a clamp and bow costing several dollars are necessary. Moreover a plate vibrated at the centre will, I think, yield to the ordinary experimenter more tones than one vibrated at the edge.

A simple method of showing the vibration in parts of a rod and a string was suggested by the vibrating plate.

The end of a piece of glass tubing was drawn into a long fine thread, and the tube attached with sealing wax to a long narrow plate near one end. Then when the plate was vibrated so as to yield a low tone, the glass thread vibrates in parts forming a series of spindle-like segments.

A piece of sewing thread was stretched from one end of the narrow plate to the other over the free end of the vibrating rod and fastened to the plate with bees-wax. Then at a low tone of the plate the thread vibrated in segments.

TYPES OF POTTERY.

By PROF. EDW. S. MORSE.

The earlier types belonging to the shell heaps of Japan were described and illustrated by specimens from each of the deposits examined by Prof. Morse and his special students.

The pottery of Yeso was nearly all cord-marked, while the shell heap pottery of the middle of Japan had a much less proportion cord-marked.

In the southern portions of Japan, at Higo, cord-marked pottery was extremely rare.

He remarked on the extreme diversity in the shape and ornamentation of the pottery in different places in Japan.

The pottery of Yeso resembling the pottery of the Northern United States; the pottery from the central portions of Japan finding their resemblance to the pottery found in Porto Rico and Jamaica. He also spoke of the hard blue pottery supposed to be Korean, and associated with it a red pottery, which might have been made by the same people. This was lathed-turned. Other forms were mentioned and illustrated by examples.